CASE SERIES OF MEDIASTINAL MASSES – A SINGLE INSTITUTIONAL EXPERIENCE

Dissertation submitted for

M.Ch DEGREE EXAMINATION

BRANCH I – CARDIOTHORACIC SURGERY

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AND

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“learn to heal ’’

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CONTENTS

CERTIFICATE

This is to certify that the dissertation entitled ***"CASE SERIES OF MEDIASTINAL MASSES – A SINGLE INSTITUTIONAL EXPERIENCE"*** *presented here is the original work done by* ***Dr.G.K.Jaikaran*** *in the department of cardio thoracic surgery, Government General Hospital, Madras Medical college, Chennai 600003, in partial fulfillment of the University rules and regulations for the award of M.Ch Cardiothoracic degree under our guidance and supervision during the academic period from 2006 - 2009.*

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Introduction

The mediastinum is an extremely important and complex part of the thorax because it contains a variety of important organs and anatomic structures. Many histologically different neoplasms and cysts that affect people of all ages arise from the multiple anatomic structures present in the mediastinum.Because this area is also the site of numerous lymph nodes, metastases secondary to lesions in other parts of the body are also frequently found. Both benign and malignant lesions are being recognized with increasing frequency, and a differential diagnosis is important whenever possible. The incidence and types of the many primary mediastinal tumors and cysts vary with the age of the patient group under consideration. In infants and children, neurogenic tumors are the most common, followed by lymphomas, foregut cysts, and benign germ cell tumors. In adults, thymic tumors are the most common surgically treated mediastinal tumors. Treatment strategies for mediastinal tumors and cysts are quite broad, depending on the nature of the disease (1).

Major changes have recently occurred in the clinical presentation, diagnosis, and management of primary lesions of the mediastinum. New diagnostic techniques and improved therapy have

led to more objective preoperative diagnoses as well as better longterm results.

Mediastinal masses are the lesions in the thoracic space bounded superiorly by the thoracic inlet; inferiorly by the diaphragm , anteriorly by the sternum posteriorly by the spine, laterally bounded by the pleural spaces, including the mediastinal pleura.

Review of Literature

ANATOMICAL PERSPECTIVES:

The mediastinum is strategically located from the thoracic inlet to the diaphragm between the left and right pleural cavities and contains vital structures of the circulatory, respiratory, digestive and nervous systems. Embryologic development leads to cells from ectodermal, mesodermal and endodermal origin ultimately residing in the small mediastinal compartment. Clinically the mediastinum may be divided into superior and inferior compartments with the inferior mediastinum being subdivided into anterior, middle and posterior sections. The topographic landmarks in each division of the mediastinum allow for directed investigative, diagnostic and therapeutic strategies (2) .

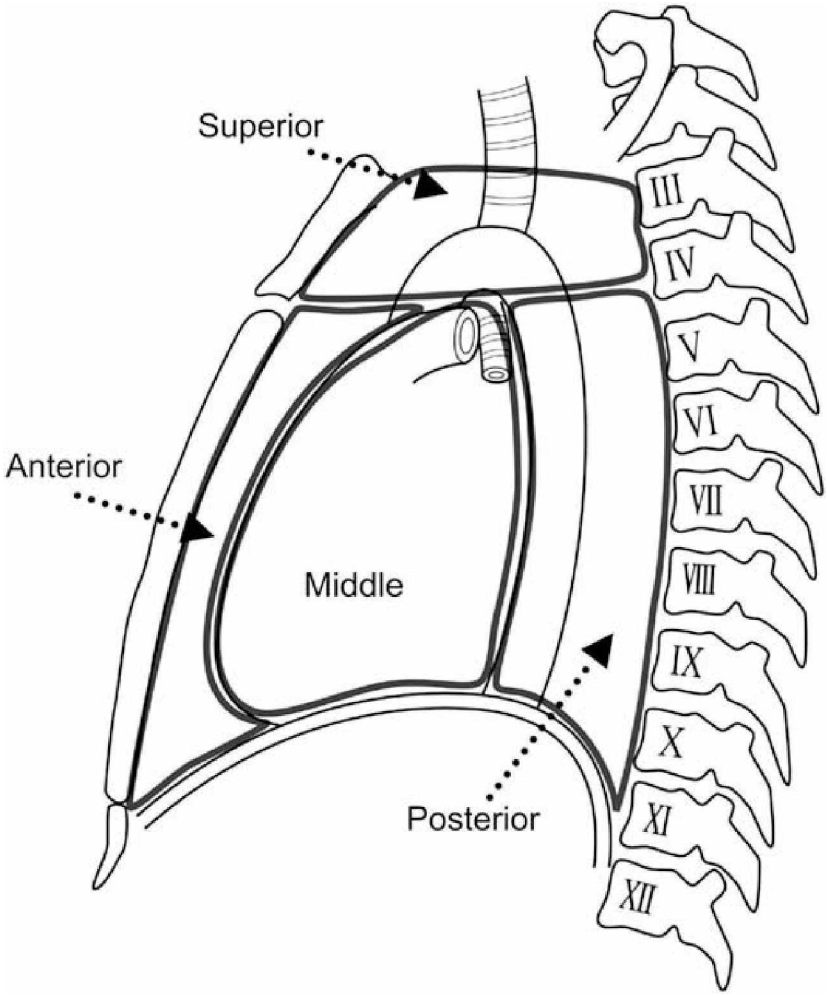
The mediastinum (from the Greek medium istemi) is an anatomic region localized at the center of the thorax, limited in front by the sternum, in the back by the spine and laterally by the lungs with their pleural lining. There are several classifications for the mediastinum, although it is Shield who classically divided this region into three areas: anterior, visceral and posterior limited by two frontal planes. The first tangent to the anterior surface of the pericardium and the large vessels, the second tangent to the anterior surface of the vertebral bodies. Thymus is found in the anterior mediastinum with the internal

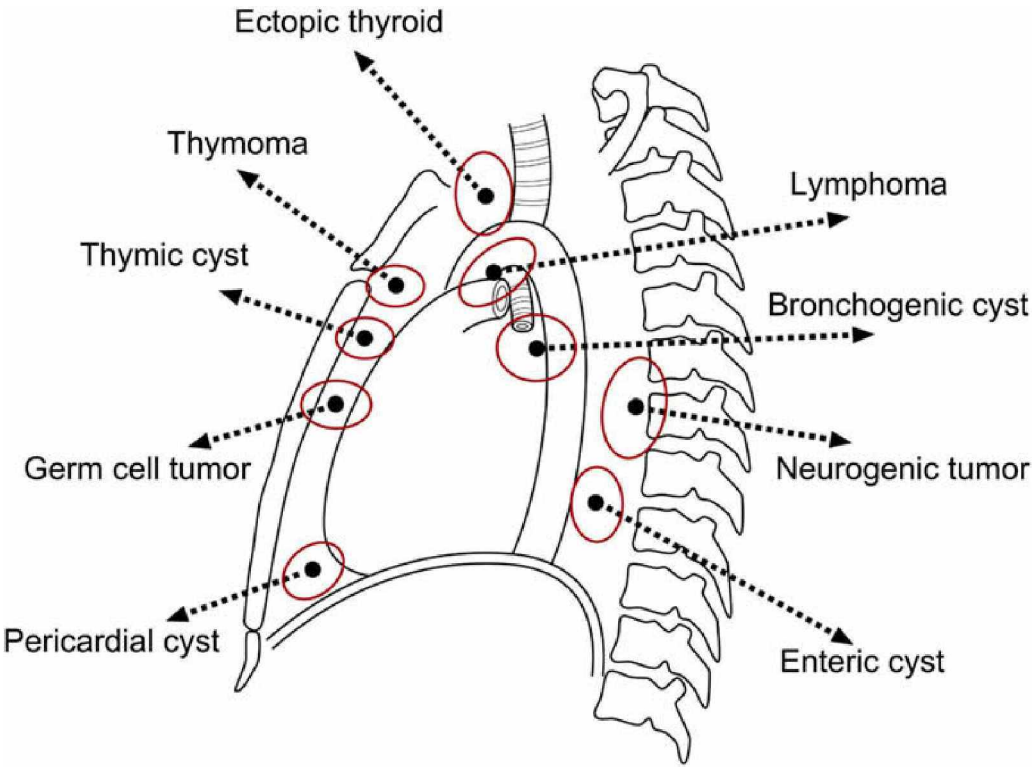
mammary vessels, the lymph nodes, connective tissue, fat-cell tissue, the lower pole of thyroid and the ectopic parathyroids.

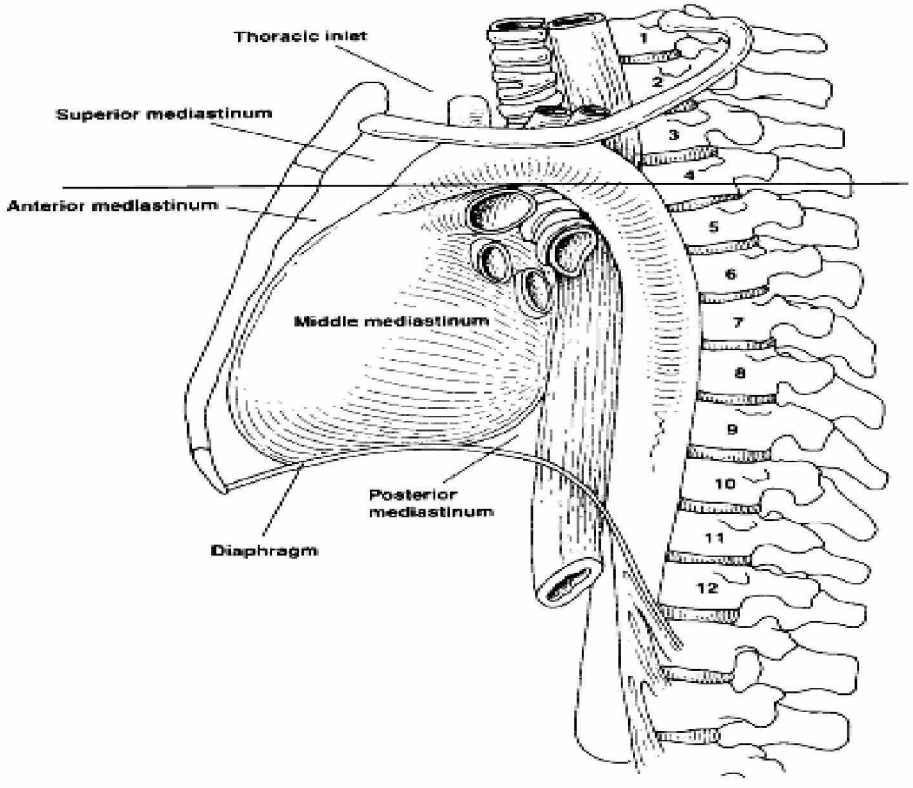
In the visceral compartment there are the heart and pericardium the great vessels ascending, and descending aorta, the aortic arch with the supraortic vessels, the pulmonary artery with the proximal segment of their branches, the distal segments of the pulmonary veins, the superior vena cava with the brachiocephalic trunks, the azygos vein, and Botallo's ligament or Botallo's pervious duct the thoracic duct nerves: vagus, phrenic, recurrent laryngeal, lymph node chains and the anterior surface of the vertebral bodies.

In the posterior compartment there are the lateral surface of the vertebral bodies, the internal surface of the intercostal muscles, the proximal segment of the intercostal nerves, the sympathetic chain with its ganglions and hemiazygos vein. The wide variety of mediastinal masses different for embryological origin, anatomic constitution, location and functional features are responsible for the various signs and symptoms which are collectively called the mediastinal syndrome, which are due to compression, obstruction or infiltration of the mass over near structures. The mediastinal syndrome includes all the symptoms caused by the pathological environment of all mediastinal

structures and systems, the cardiovascular, respiratory, digestive and lastly the peripheral and central nervous system. It can be total, affecting all three compartments or partial, with anterior, median or posterior mediastinal syndrome. In addition, it is important to mention systemic syndromes associated with tumoral masses and syndromes of endocrinal hypersecretion caused by tumors.




Ectopic thyroid
Thymoma
Thymic cyst
Germ cell tumor
Pericardial cyst
Lymphoma
Bronchogenic cyst
Neurogenic tumor
Enteric cyst


Thoracic inlet
Superior mediastinum
Anterior mediastinum
Middle mediastinum
Posterior mediastinum
Diaphragm
1
2
3
4
5
6
7
8
9
10
11
12

ANTERIOR MEDIASTINAL TUMORS:

- Thymic tumors
- Lymphoma
- Germ Cell Tumors
- Endocrine tumors
- Mesenchymal tumors

THYMIC TUMORS :

- Incidence – 15 per 1 lakh per person per year
- 50% of anterior mediastinal tumors
- 30% in adults and 15% in children
- Various lesions
    - Thymic Hyperplasia
    - Thymoma
    - Thymic cyst
    - Thymolipoma
    - Thymic Carcinoma
    - Thymic Neuroendocrine tumors
- Developed as pairs of epithelial anlagen in ventral portion of third pharyngeal pouch.
- Histology

- 6 types - 4 in cortex , 2 in medulla
- Type 6 cells are called Hassals Corpuscles

Classification of thymic tumors

- Rosal and Levine Classification
- Marino and Muller Hermeling
- WHO Staging
- Masoaka staging – provides more precious prognostic information

Associated diseases

- Myasthenia
- Cytopenia
- SLE, RA, Polymyositis.

MYASTHENIA GRAVIS:

Most common associated disease with thymoma is myasthenia gravis, 5 to 15 % of myasthenia gravis are found to have thymomas. 30 to 50 % of thymomas are associated with clinical myasthenia gravis The disease may develop later even after thymectomy, for this reason it is essential that complete thymectomy be performed as a part of resection of any anterior mediastinal tuimors that may present as thymoma.

GERM CELL TUMORS:

Anterior mediastinum is the most common location for occurence of extra gonadal germ cell tumors accounting for 15 to 20% of all anterior mediastinal masses.

- Benign mediastinal teratoma

  Accounts for 60% of mediatinal germ cell tumors Usually asymptomatic in adults

  Presents in children due to airway compression

- Malignant mediastinal teratoma

  Seminomatous – 40%

  Non seminomatous – 60 % - Embryonal cell carcinoma
  - Choriocarcinoma
  - Yolkm Sac tumor
  - Teratocarcinoma

These generally present as diffuse non discrete anterior mediastinal masses. Serum levels of AFP , B-HCG , LDH may be helpful.

MIDDLE MEDIASTINAL TUMORS

- Cysts
- Lymphomas
- Mesenchymal tumors
- Carcinoma

LYMPHOMAS:

The mediastinum is commonly involved by malignant lymphomas. Most mediastinal lymphomas occur in the anterior or middle mediastinal compartments. They usually arise from mediastinal lymph nodes but may arise from the thymus gland or other mediastinal structures. About 50% of Hodgkin's disease and 20% of non-Hodgkin's lymphomas present as mediastinal lymphomas. The size of the mass dictates whether symptoms are present. Bulky mediastinal disease usually causes compression symptoms. Patients commonly have chest pain or heaviness and cough. Dyspnea may result from large airway compression, lung compression, pleural effusion or pericardial effusion. Due to the right sided predominance of paratracheal lymph nodes, SVC syndrome is relatively common (20–60% of patients), especially in those with non-Hodgkin's lymphoma. Diagnosis of Hodgkins is proven by the presence of Reed Sternberg cells. Management is basically chemotherapy / radiotherapy.

CYSTIC LESIONS

20% of all mediastinal masses. Common in the middle mediastinum and rarely in the posterior mediastinum which comprises of

- Bronchogenic cyst
- Hydatid cyst
- Enteric cysts
- Intramural esophageal
- Neuro enteric cysts

Bronchogenic cysts : 60 % of mediatinal cysts. Part of spectrum of broncho pulmonary foregut abnormalities including extralobar, intralobar sequestration and congenital cystic adenomatoid malformation. Presents as chest pain , cough, hemoptysis. The cyst is lined by ciliated columnar epithelium and excision in toto is the treatment of choice.

Gastroenteric sycts : These are duplication cysts, which are peri esophageal lesions that form from posterior division of primitive foregut. May arise in middle or posterior mediastinum lined by non keratinizing squamous ciliated columnar gastric or small intestinal epithelium. Presents as cough or dyspnoea, excision is the treatment.

Neuroenteric cysts: Develops because of failure of separation of notochord form primitive gut. Presents in infants less than 1 year of age. It is connected to meninges. Possess endodermal or ectodermal neurogenic element. Associated with scoliosis , hemivertebrae, spina bifida. Excision is the treatment of choice.

OTHER MEDIASTINAL TUMORS

- Amyloid masses
- Castleman's disease
- Chordomas
- Fibromas
- Mesotheliomas
- Rhabdomyosarcomas
- Myxomas
- Hemangiomas
- Lymphangiomas

CLINICAL FEATURES

- 40% are asymptomatic . Detected incidentally by routine chest x-ray.
- 60% are symptomatic. Symptoms may be due to
    - § Compression – cough, dyspnoea, stridor.
    - § Invasion – pain, hoarseness, Horner's syndrome

- § Paraneoplastic syndromes
- § Haemoptysis

- Asymptomatic patients usually present with benign lesions while symptomatic likely to have malignant disease.

THYMOMAS

- anterior mediastinum
- cough, dyspnoea, hoarseness of voice
- myasthenia gravis

GERM CELL TUMOR

- anterior mediastinum
- chest pain, dyspnoea, cough ,fever

NEUROGENIC TUMORS

- posterior mediastinum
- pain, paeresthesia, Horner's syndrome, muscular atrophy, SVC syndrome.
- In infants and children the tumor is malignant , where as
- benign in adults

LYMPHOMAS

- Middle, posterior mediastinum
- Presents as cough, fever, dyspnea, mass
- SVC syndrome (right sided NHL)

CYSTIC LESIONS

- Middle, posterior mediastinum
- Usually asymptomatic
- Occassionally presents as cough, pain, compressive symptom.

Endocrine hypersecretion syndromes associated with mediastinal masses (3)

S. Cushing	Thymoma
Gynecomastia	Germ-cell tumor
HCG increase	Germ-cell tumor
Leyding's cell stimulation	Germ-cell tumor
Arterial hypertension	Pheochromocytoma
Diarrhea	Ganglioneuroma
	Ganglioneuroblastoma
	Neuroblastoma
Hypercalcemia	Lymphoma
Hypoglycemia	Teratoma
	Fibrosarcoma
	Neurosarcoma

EVALUATION OF MEDIASTINAL MASSES

History and Physical Examination

Chest Radiograph (Posteroanterior and Lateral)

Mediastinal Mass

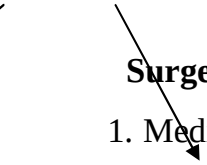
CT Scan of Thorax

MRI (If indicated)

Angiography (If indicated)

ENDOSCOPY (If indicated)

Suspect Mediastinal Tumor



Biopsy

1. Scalene node
2. Mediastinoscopy
3. Fine needle aspiration
4. FOB

Surgery

1. Median Sternotomy
2. Lateral Thoracotomy

Mediastinal tumours have similarities in presentation, investigation and surgical approach depending on the anatomical compartment in which they arise. The anterior compartment is bordered by the sternum anteriorly, the pericardium posteriorly and the mediastinal pleuralaterally. The main structure in the anterior compartment is the thymus, though retrosternal thyroid or parathyroid tumours as well as germ cell, lymphoma and rare vascular tumours also occur there. The usual surgical approach is via median sternotomy though unilateral disease or the presence of associated pleural disease may be better approached by a lateral thoracotomy.

The visceral (middle) compartment, from the anterior pericardium back to the pre-vertebral fascia and bounded by both pleura, includes the heart, trachea, main bronchi and oesophagus.

The posterior compartment, better referred to as the paravertebral sulci, includes those structures medial to the pleura but excluding the vertebral column. The common tumors in this area are the neurogenic tumours arising from intercostal nerves and the sympathetic chain. Though such tumours arise in the posterior mediastinum they can encircle vital structures of the visceral compartment preventing complete excision. Cartilage and bone tumours of the necks of the ribs

can mimic posterior mediastinal tumours. The surgical approach to the posterior mediastinum is via posterior thoracotomy with paravertebral extension where a tumour permeates through an intervertebral foramen.

Presentation

Mediastinal tumours in children are usually symptomatic with respiratory symptoms such as cough, stridor and dyspnoe. Malignant lesions are often accompanied by lethargy, fever, malaise and chest pain. In adults many lesions are asymptomatic, found incidentally on routine chest radiographs. However, obstructive symptoms do occur when the tumour compresses on the superior vena cava, oesophagus or tracheo-bronchial tree and cardiac tamponade can be caused by large anterior compartment tumours. Invasion of phrenic, recurrent laryngeal or sympathetic chain nerves may also cause symptoms of breathlessness, hoarseness or Horner's syndrome respectively.

Diagnosis

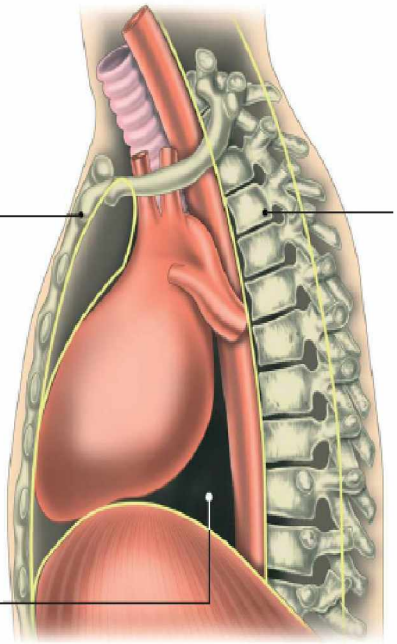
Imaging of the mediastinum is crucial in distinguishing tumours from other benign cystic lesions (thymic, bronchogenic, enteric duplication, neuroenteric, mesothelial and cystic hygroma) and granulomatous lesions (sarcoidosis, histoplasmosis and tuberculosis).

A CT scan or MRI scan will outline the exact site of the lesion and will give clues to the diagnosis, a variegated appearance suggesting teratoma. These scans will also give an indication of malignant invasion of adjacent structures and pleural metastases which in the case of thymoma produce a "droplet" pattern.

Fine needle aspiration cytology is frequently inadequate to differentiate thymoma from lymphoma and almost never provides enough tissue to differentiate between types of lymphoma, an important consideration, as Hodgkin’s and non-Hodgkin’s lymphoma are treated by different modalities in the first instance. A core biopsy is sometimes safe and productive though the proximity of the aorta and other great vessels dissuades some radiologists. Mediastinoscopy, mediastinotomy via anterior mini-thoracotomy or thoracoscopy may be required to provide enough tissue for the pathologist to make a full diagnosis. In patients who are unstable due to compression or obstruction of a vital organ treatment with steroids, radiotherapy or chemotherapy may need to be commenced before a full diagnosis is obtained surgically.

Thymic tumours are unique in that they are associated with a number of paraneoplastic or "parathymic" syndromes. The rare paraganglionic neurogenic tumours may be also be functional in that

they produce biogenic amines. In this regard they resemble phaeochromocytoma. Vanillylmandelic acid or homovanillic acid may be detectable in the urine. Haematological markers of germ cell tumours (beta-HCG and alpha feto-protein) should be sought. Both markers are negative in benign teratoma but both tend to be elevated in malignant non seminomatous tumours. The beta hCG may be elevated in seminoma but the presence of an elevated alpha feto-protein suggests that there are non seminomatous elements which need to be treated as such.



Masses of anterior compartment

- Masses of the thymus
- Germ-cell tumors
- Lymphomas
- Lymphangiomas
- Hemangiomas
- Lipomas
- Fibromas
- Fibrosarcomas
- Morgagni–Larrey hemia with hepatic content (rare)
- Parathyroid adenoma (rare)

Mases of posterior compartment

- Neuroblastomas
- Ganglioneuroblastomas
- Genglioneuromas
- Schwannomas
- Pheochromocytomas
- Fibrosarcomas
- Neuroenteric cysts
- Lateral meningocele (rare)
- Lymphomas
- Aneurysmatic vertebral cysts

Masses of visceral compartment

- Abnormalities of the primitive intestine (bronchogenic cysts, oesophageal duplications)
- Lymphomas
- Pericardial cysts
- Vascular masses
- Mesothelial cysts
- Lymphoid hamartoma
- Mediastinal granulomas
- Paragangliomas
- Pheochromocytomas
- Thoracic duct cysts

Systemic syndromes associated with mediastinal masses

Myasthenia gravis	Thymoma
Hypogammaglobulinemia	Thymoma
Systemic lupus erythematosus	Thymoma
Scleroderma	Thymoma
Fever of unknown origin	Lymphoma
Claude Bernard–Horner	Neuroblastoma
Parfour-Depetit	Neuroblastoma
Opsoclonus-myoclonus	Neuroblastoma
Vertebral anomalies	Intestinal duplications

INVESTIGATIONS (1)

When a mediastinal lesion is recognized on standard radiographs of the chest, the diagnostic possibilities can be narrowed to a reasonable number by considering the patient's age, the location of the mass, and the associated symptoms and signs present. At first, a careful evaluation of the history signs, and symptoms is valuable. Various imaging modalities are currently available and provide excellent depiction of the mediastinal lesions. The main imaging modalities used are chest radiography, CT, MRI, and positron emission tomography (PET).

CT is routinely indicated when a mediastinal lesion is detected by chest radiography. The rapid acquisition of the entire thorax during a single breath-hold minimizes motion artifacts and allows optimal vascular contrast enhancement (1). It allows a reliable evaluation of the mediastinal anatomy and the relationship of the lesions with adjacent structures. CT is a sensitive method of distinguishing between fatty, vascular, cystic, and soft tissue masses. However, the differentiation of a cyst and a solid tumor is not always accurate (2). MRI may supply additional useful information in separating mediastinal tumors from vessels and bronchi, especially when the use of contrast material is contraindicated. MRI is more accurate than CT in assessing tumor

invasion to the great vessels, heart, and chest wall, and in distinguishing a cyst from a solid tumor (3,4). T1-weighted images are most valuable in anatomic assessment, whereas T2-weighted images are most valuable in tissue characterization. A cyst has homogeneous high-signal intensity on the T2-weighted image and can be distinguished from a solid tumor. PET using fluorine-18 fluorodeoxyglucose (FDG) has emerged as a diagnostic tool for staging several types of neoplasms. Fusion of FDG-PET with CT images (PET/CT) further increases the diagnostic accuracy by depicting more precisely the anatomic site of uptake and avoiding misinterpretation of normal hypermetabolic area as disease.

FDG-PET is useful in differentiating thymoma from hyperplasia in myasthenia gravis, (5) and may be useful for predicting the grade of malignancy in thymic epithelial tumors (6). Radioisotope scanning has been of specific aid in establishing a definitive diagnosis for ectopic thyroid and parathyroid tumors. Biochemical makers and elevated hormone levels are present in patients with various mediastinal tumors. Infants and children with a paravertebral mass should be evaluated for excessive norepinephrine and epinephrine production. This increased production is present in association with most neuroblastomas and

ganglioneuroblastomas. Young adult men with an anterior mediastinal mass should have determinations of levels of Ţ-fetoprotein and β-hCG. Either one or both are elevated in the presence of a nonseminomatous germ cell tumor. Antiacetylcholine receptor antibodies should be measured in patients with thymoma because occult myasthenia gravis may be found. Serum-soluble interleukin-2 receptors may be elevated in the presence of mediastinal lymphoma. Hypokalemia, high-serum cortisol, and adrenocorticotropic hormone (ACTH) levels are seen in some patients with thymic carcinoid tumors that produce an ectopic secretion of ACTH.

METHODS FOR PATHOLOGIC DIAGNOSIS (1)

A variety of biopsy techniques for obtaining tissue from the mediastinum have been described, including ultrasound guided endoscopic biopsy, percutaneous image-guided needle biopsy, parasternal anterior mediastinotomy, cervical mediastinoscopy, video-assisted thoracoscopic surgery and open surgical procedures.

Percutaneous US-Guided Needle Biopsy:

Ultrasonography is an effective modality for guidance of percutaneous biopsy. Compared with CT, US-guided biopsy offers a number of advantages including bedside approach, lower cost, lack of radiation exposure, and real-time monitoring (7). With real-time monitoring by means of US guidance, the tip of the biopsy-needle can be monitored throughout the procedure. Another great advantage of US-guided biopsy is that it can approach the lesion from any direction. This advantage allows biopsy of an upper mediastinal lesion via a supraclavicular approach . CT-guided biopsy of this region is usually hindered by surrounding bony structures at an axial plane. On the other hand, the greatest limitation of USguided biopsy is that its clinical application for thoracic lesions is generally confined to anterior or

posterior mediastinal tumors that are in contact with the chest wall. The USG units equipped with Doppler US may be preferable, as Doppler USG can be used to detect vessels and blood flow that should be avoided from the biopsy root. After confirming the biopsy root, the USG probe is equipped with a sterile puncture transducer with a guiding channel. If the lesion is less than 20 mm to 22 mm in diameter, the tip of the needle should be placed at least 20 mm away from the posterior margin of the lesion. To reduce the false-negative rate, having a cytologist present during biopsy has been advocated.

Percutaneous CT-Guided Needle Biopsy

This procedure is performed percutaneously under CT-fluoroscopic guidance.9 Before the procedure, CT images are obtained for targeting the lesion. The needle path is determined, avoiding interlobular fissures, visible bronchi, and relatively large vessels. The needle path may be through the lung , a route that cannot be used in US-guided biopsy. After the administration of local anesthesia, the introducer needle is advanced along the determined path until its tip is in front of the lesion. Acquisition of a specimen is repeated until the specimens obtained are considered adequate for histologic evaluation. Chest CT images are obtained to evaluate procedural complications.

Pneumothorax (8%–61%) is the most commonly encountered complication after USG guided or CT guided needle biopsy, followed by hemoptysis (1.6%–3%).

USG-Guided Endoscopic Biopsy

Endobronchial ultrasound , first introduced during the early 1990s, has emerged as a new diagnostic tool that allows visualization beyond the airway.10 Because of the development of miniaturized radial probes with flexible catheters having a balloon at the tip (Fig. 6), bronchoscopists can perform real-time EBUS-guided transbronchial needle aspiration (EBUS-TBNA). Although EBUSTBNA is mainly used for lymph node staging in lung cancer, it can also be used for tissue diagnosis for middle mediastinal lesions. A 22-gauge needle is passed through the airway wall and inserted into the lesion under real-time ultrasound control. Esophageal US-guided fine-needle aspiration needle biopsy is sometimes indicated for the posterior- and inferior-mediastinal lesions. EBUS-TBNA is minimally invasive and can be performed quite safely under local anesthesia. The disadvantages are that the tissue sample is small, the procedure is time-consuming and technically demanding, and it requires expensive tools. It is for these reasons that this procedure can be performed only in some centers.

Parasternal Anterior Mediastinotomy

When needle biopsy has failed, many surgeons prefer Chamberlain's approach:11 an open biopsy using a parasternal anterior mediastinotomy. The patient is placed under general anesthesia in a supine position. Local anesthesia is occasionally used. A 3-cm to 4-cm transverse parasternal skin incision is made at the desired intercostal space, depending on the location of the tumor. Great care should be taken to stay lateral to the internal mammary vessels. Under direct visualization between the ribs and using biopsy forceps, an adequately sized specimen can be obtained from an anterior mediastinal tumor. Para-aortic lesions and masses arising from the aortopulmonary window can be reached by inserting a mediastinoscope through the parasternal incision.

Mediastinoscopy

Conventional mediastinoscopy and recently developed video mediastinoscopy are generally used for evaluating the mediastinal lymph nodes in patients with carcinoma of the lung. These techniques are also useful for the diagnosis of mediastinal lesions located in the pretracheal, paratracheal, and subcarinal spaces.12 Under general

anesthesia, a small transverse incision is made 2 cm above the sternal notch. The pretracheal fascia is incised and a tunnel created by gentle finger dissection along the anterior and lateral walls of the trachea in to the mediastinum. The mediastinoscope is then introduced and advanced further by means of blunt instrument dissection to extend the mediastinal tunnel. Great care should be taken to avoid vascular injury and left-recurrent nerve palsy. An adequately sized tissue sample can be obtained using biopsy forceps.

Video-Assisted Thoracoscopic Surgery

Video-assisted thoracoscopic surgery (VATS) has been widely used for various types of thoracic surgery. Under general anesthesia, the patient is intubated with a double-lumen endotracheal tube and placed in a lateral decubitus position. With the lung collapsed, the entire thoracic cavity is visible. VATS is a valuable procedure, especially in cases of lesions with difficult access that require direct vision, such as tumors close to great vessels or the heart.13,14 The disadvantage of VATS biopsy for mediastinal tumor is possible tumor seeding to the thoracic cavity by opening the pleura.

DECISION-MAKING

One can make a reasonable preoperative diagnosis for each lesion by considering the age of the patient, location, the presence or absence of symptoms and signs, the association of a specific systemic disease, radiographic findings, and biochemical markers. The decision about how to managea mediastinal tumor could be made by observation, surgical resection, chemotherapy, radiotherapy, or multimodality therapy depending on the nature of the disease. Since the introduction of VATS, the threshold for surgical resection of the lesion has been lowered. In most patients with cystic lesions or probable benign solid tumors, such as neurogenic tumors in adults, VATS extirpation of the lesion is recommended without biopsy, being both diagnostic and therapeutic simultaneously. When radiographs show typical signs of benign germ cell tumors, mature teratomas, or early stage thymomas, it is recommended for open or VATS resection without biopsy. It is much more difficult to make a precise diagnosis for poorly demarcated tumors in the anterior or middle mediastinum. Thymomas, thymic carcinomas, seminomas, nonseminomatous germ cell tumors, and lymphomas are quite similar in radiographic appearance but are quite different in treatment strategy. Therefore,

pathologic diagnosis is required to select the optimal treatment modality. Several techniques and approaches have been previously described and are available to obtain specimens of mediastinal tumors. The choice of technique depends on the location of the lesion, clinical factors such as the age and condition of the patient, and the availability of special techniques with the required expert and the necessary equipment. In general, percutaneous biopsy is the first diagnostic choice because it can be done under local anesthesia.

Aims & Objectives

Retrospective nonrandomized observational study to review and analyze the experience in diagnosis and surgical management with emphasis on the evolution of surgical techniques at our institution in the treatment of Mediastinal Masses.

Materials and Methods

71 consecutive patients diagnosed with mediastinal masses admitted in the Department of Cardiovascular and Thoracic surgery, Madras Medical College, Chennai, between September 2006 to April 2009 comprised the sample for this study. Case sheets of patients were obtained from Medical Record Department for analysis. A detailed clinical examination and findings were recorded over structured proforma (Annexure) for all patients.

All patients under this study are classified according to their age, sex, mode of presentation, method of diagnosis, site of the tumour, surgical approach and postoperative morbidity, mortality work up.

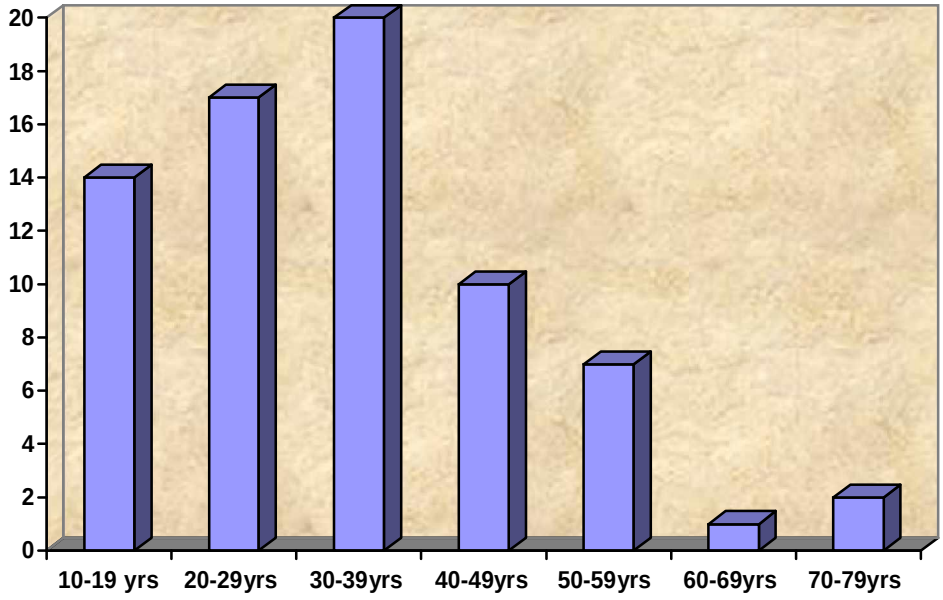
All patients were assessed and taken up for surgery. Under GA using double lumen ETT, patients were subjected for surgical procedure. Depending on the location and diagnosis, the necessary surgical procedure performed. Surgery was either incision biopsy, excision biopsy or debulking based on the tumor and sent for HPE.

Post operative biopsy results were analysed compared and confirmed. Necessary patients were either referred to chemotherapy, radiotherapy or discharged home.

Observations and Results

AGE DISTRIBUTION OF THE STUDY POPULATION

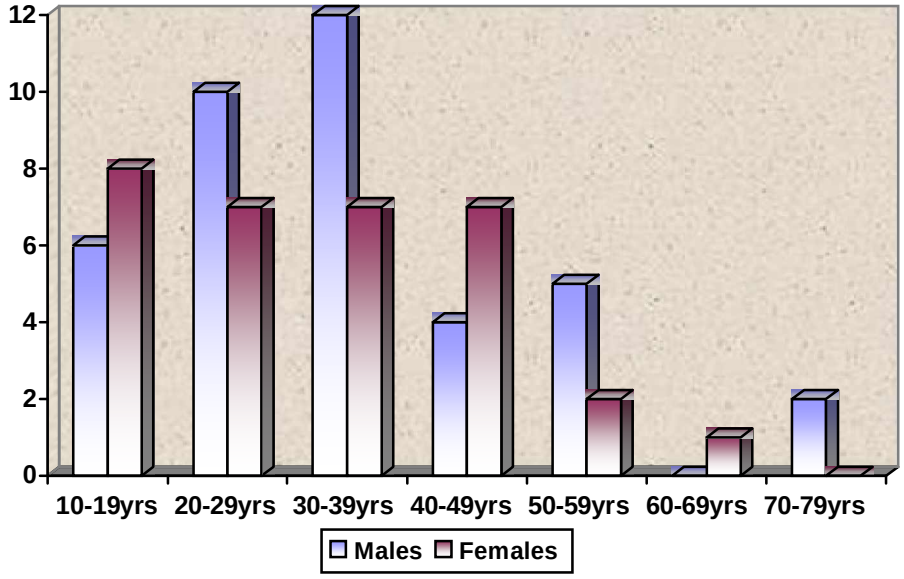
Age group	Total No: of cases
10-19 years	14
20-29 years	17
30-39 years	20
40-49 years	10
50-59 years	7
60-69 years	1
70-79 years	2



The total number of patients in this study is 71 patients. On classifying the age distribution of the study population, it was observed that the majority of the patients belonged to the 30 to 39 year age group, forming about 28.27% of the total number of patients. The next to follow are the 20 to 29 years age group forming about 23.94%.The least number of patients was found in the 60 to 69 year age group.

SEX DISTRIBUTION

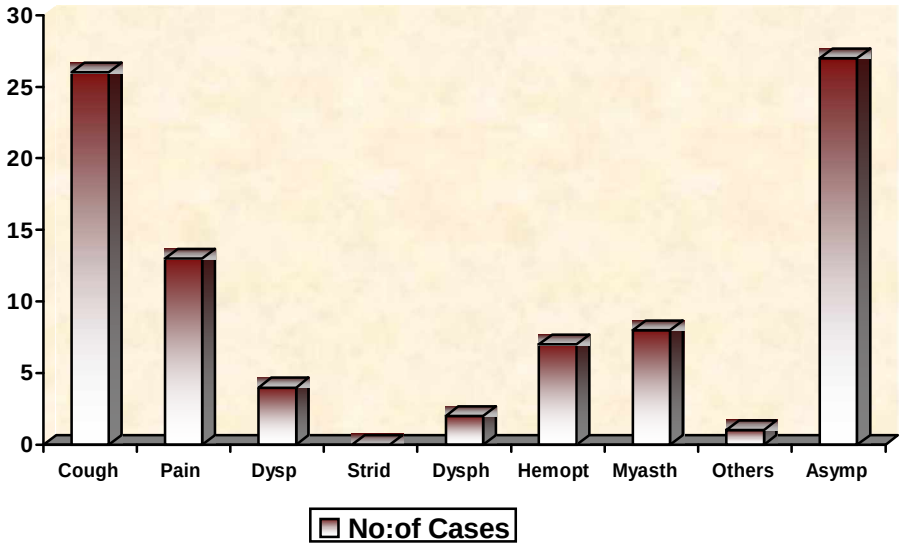
Age group	Males	Females
10-19	6	8
20-29	10	7
30-39	12	7
40-49	4	7
50-59	5	2
60-69	0	1
70-79	2	0
Total	39	32



On calculating the age wise sex distribution, it was noted that males formed 54.93% of the total, female patients forming 45.07%. Male preponderance was noted in th 20 to 39 age distribution, while females outnumbered male patients in the 10 to 19 age group and 40 to 49 age groups.

SYMPTOMS

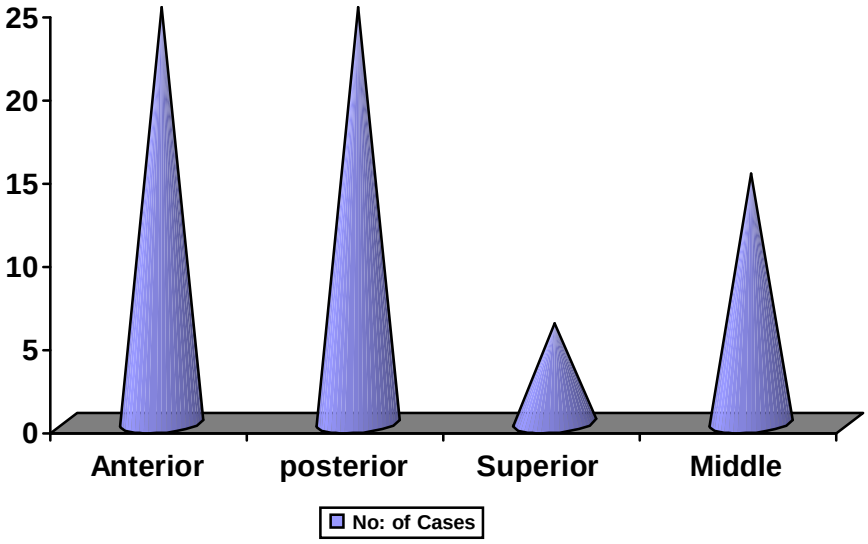
Symptoms	No. of cases
Cough	26
Pain	13
Dyspnoea	4
Stridor	0
Dysphagia	2
Haemoptysis	7
Myasthenia	8
Others	1
Asymptomatic	27



Of the total number patients, 52 of them presented symptomatically while, 27 patients were asymptomatic at presentation and diagnosis was coincidental. Of the presenting symptoms, cough was the major symptom , seen in 36.62% of patients.The other presenting symptoms were pain (18.31%), dyspnoea (5.6%), Hemoptysis (9.8%) and dysphagia (2.8%).

LOCATION OF TUMOURS

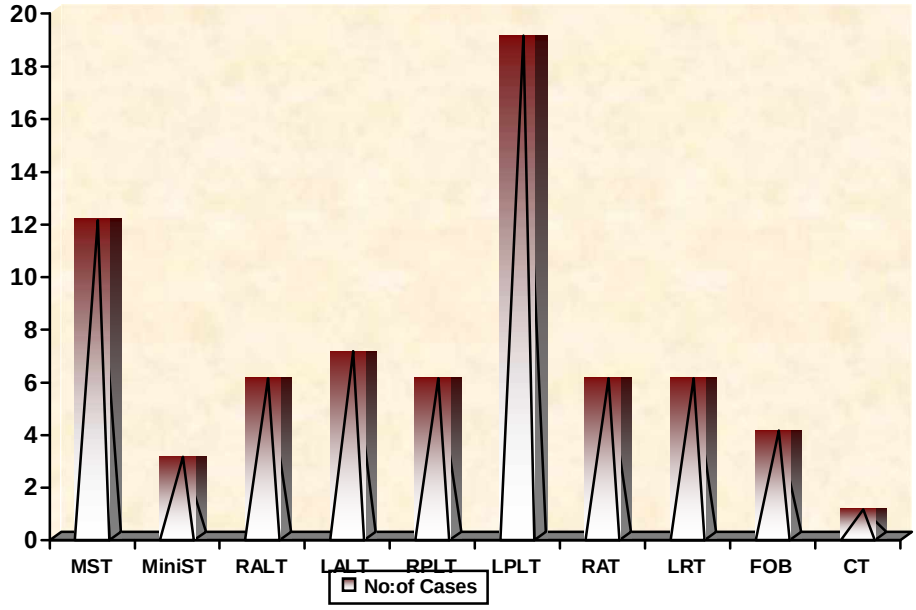
Location	No: of Cases
Anterior Mediastinum	25
Posterior Mediastinum	25
Superior Mediastinum	6
Middle Mediastinum	15



Majority of the cases were seen in the anterior and posterior mediastinum, 50 patients out of 71 patients, i.e. 70.42% of tumors, followed by tumors of the middle mediastinum , which form 21.12% ,i.e. 15 patients in 71 total patients. Superior mediastinum masses form about 8.45% of the total patients.

SURGICAL APPROACHES

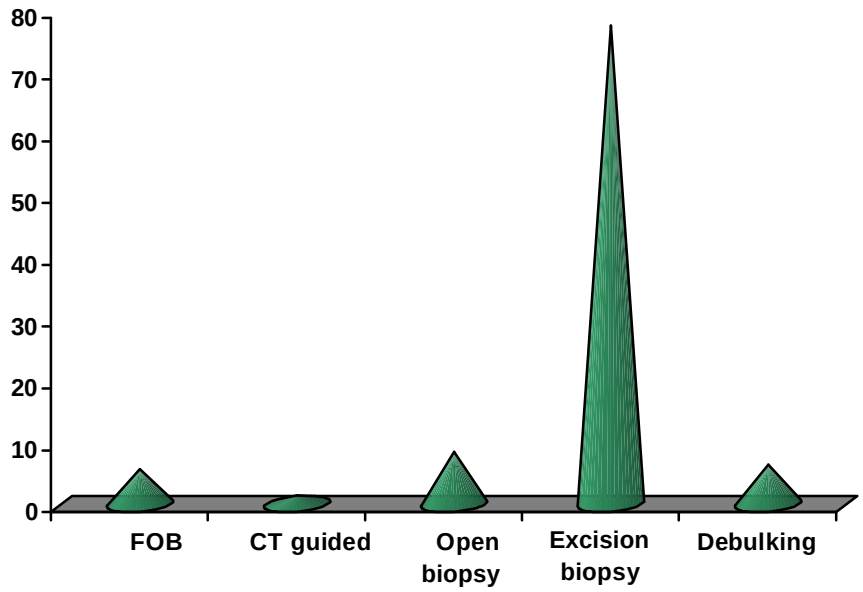
	No. of Cases
Median Sternotomy	12
Mini Sternotomy	3
Right Anterolateral Thoracotomy	6
Left Anterolateral Thoracotomy	7
Right Posterolateral Thoracotomy	6
Left Posterolateral Thoracotomy	19
Right Anterior Thoracotomy	6
Left Anterior Thoracotomy	6
FOB – Biopsy	4
CT – Biopsy	1



Of the surgical approaches used in the treatment of the patients, thoracotomy was the most commonly used approach amounting to 50 out of the 71 patients, i.e. 70.42%. Of all the thoracotomy approaches, Left Posterolateral approach was the most common approach. Sternotomy was used in 12 patients, i.e. 16.9%. Ministernotomy was done in3 patients and endoscopic biopsy was done for 4 patients.

SURGICAL PROCEDURE

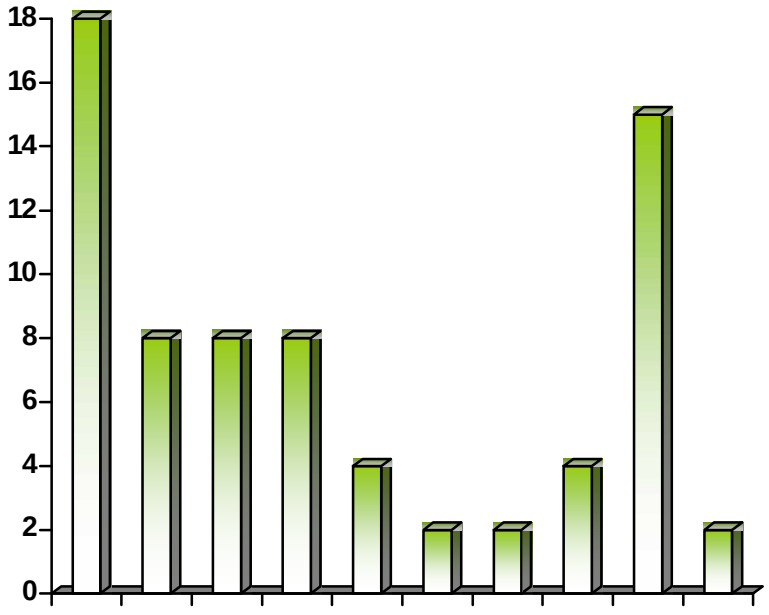
	No. of Patients
FOB	5.6
CT GUIDED	1.4
OPEN BIOPSY	8.4
EXCISION BIOPSY	77.46
DEBULKING	6.4



Among the total patients, majority were treated with excision biopsy. Of the remaining patients, 6 underwent open biopsy, 5 underwent debulking, 4 were biopsied treated endoscopically, and 1 patient were treated under CT guidance.

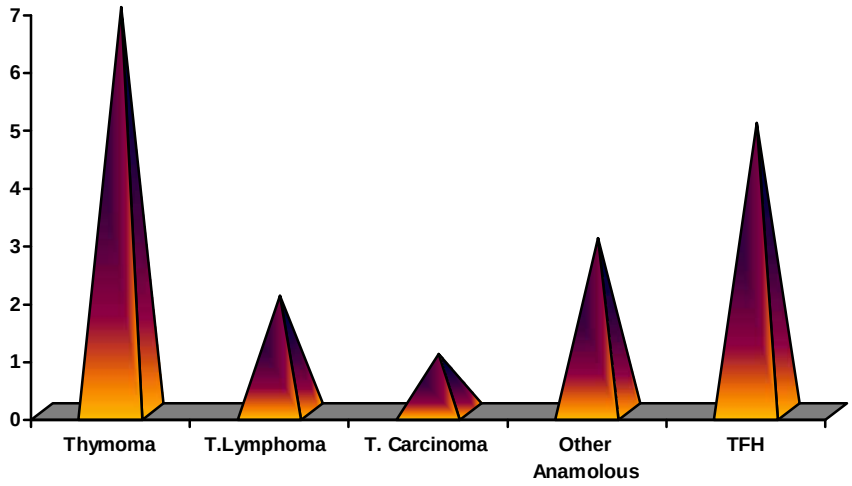
DISTRIBUTION OF MEDIASTINAL TUMORS

Tumor Type	No. of Cases
Thymic tumors	18
Cystic lesions	8
Neurogenic tumors	8
Germ cell tumors	8
Lymphomas	4
Oesophageal lesions	2
Pleural lesions	2
FOB	4
Others	15
Specimen inconclusive	2



DISTRIBUTION OF THYMIC TUMOURS

Pathological Diagnosis	No: of Cases
Thymoma	7
Thymic Lymphoma	2
Thymic Carcinoma	1
Other anomalous lesions	3
Thymic Follicular Hyperplasia	5



Thymic masses consisted of 18 patients (25.35%) . Of the thymic tumors, 38.89% were thymomas, 11.1% were tthymic lymphomas, 1 patient had thymic carcinoma, i.e. 0.6%. Of the remaining patients, 16.66% had miscellaneous anomalous lesions and 27.78% had thymic follicular hyperplasia.

THYMIC TUMORS

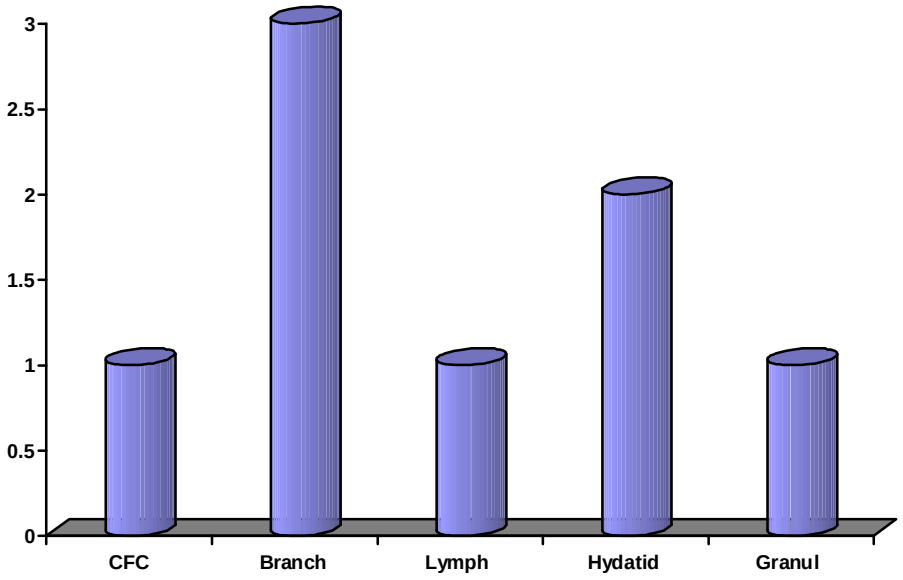
	No. of patients
With myasthenia	8
Without myasthenia	10

	No. of patients
Benign	17
Malignant	1

Among the 8 patients with myasthenia gravis , 6 patients required 4 cycles of plasmapheresis preoperatively and 4 cycles of plasmapheresis postoperatively followed by tablet pyridostigmine, 2 patients did not require plasmapheresis

CYSTIC LESIONS

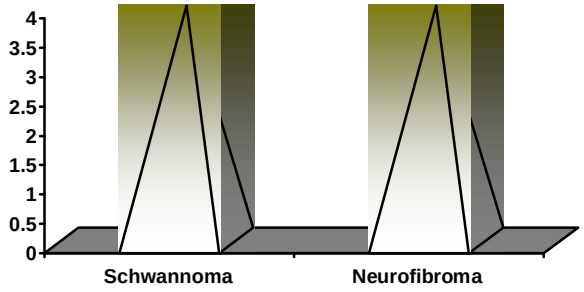
	No. of Cases
Collagenous fibrous cyst	1
Branchial cyst	3
Lymph cyst	1
Hydatid Cyst	2
Granulation Cyst	1



Cystic lesions formed 11.26% of the total number of patients (8 of 71 patients). Of these branchial cysts were diagnosed in 3 patients, hydatid cyst in 2 patients, granulation cyst and lymph cyst in 1 patient each .

NEUROGENIC TUMOURS

	No. of Cases
Schwannoma	4
Neurofibroma	4



Of the 71 patients, 8 patients were diagnosed with neurogenic tumours. Of these neurogenic tumours, 50 % were schwannomas and remaining 50% were neurofibromas

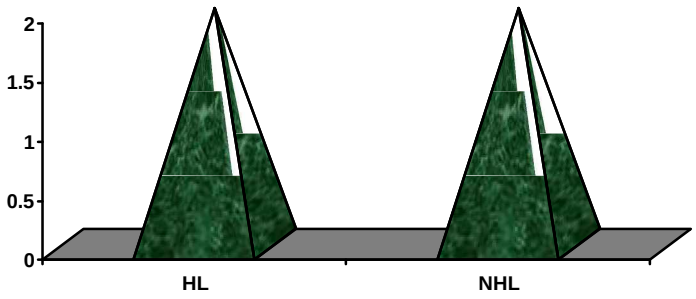
GERM CELL TUMOURS

	No: of Cases
Mature teratoma	7
Immature teratoma	1

Germ cell tumors were diagnosed in 8 patients of the total 71 patients. Of these patients, 7 patients had mature teratomas, i.e. 87.5% and the remaining 1 patient had immature teratoma forming 12.5%.

LYMPHOMAS

	No. of patients
Hodgkins Lymphoma	2
Non-Hodgkins Lymphoma	2



Immunohistochemistry was done for the 2 NHL patients. The first patient's report showed CD3-ve,CT20-positive, CT45- positive. (Large Cell NHL). The second patient (Atypical B cell proliferation) showed CD20, CD799 positive. CD3, CIL, CD43 negative. KI Index 10 to 15%.

Thymic tumors were found predominantly in anterior compartment (15 out of 18). Teratomas were present in (anterior 3, middle 2, posterior 2, superior 1), the commonest being anterior compartment. Neurogenic tumors were found exclusively in the posterior compartment (8 out of 8). Cystic lesions were found predominantly in the middle compartment (7 out of 8).

FOB LESIONS

	No. of Cases
Inconclusive Right Bronchial Lesion	2
Necrotic Material	1
Inconclusive Left Bronchial Lesion	1

Of the patients managed endoscopically, 2 patients had an inconclusive right bronchial lesion (50%), 1 patient had inconclusive left bronchial lesion (25%) and the remaining 1 patient had necrotic material (25%).

PLEURAL LESIONS

	No. of Cases
Sarcoma	1
Fibroma	1

OESOPHAGEAL LESIONS

	NO: OF CASES
MOD DIFF KERATINIZED SCC	1
SCC MOD DIFF	1

SPECIMEN INCONCLUSIVE – 2 CASES

In the remaining patients having miscellaneous lesions, pleural lesions were found in 2 patients, 1 patient being diagnose with pleural sarcoma and the other with pleural fibroma. 2 patients were diagnosed with oesophageal problems, 1 being moderately differentiated squamous cell carcinoma and the other being moderately differentiated keratinized squamous cell carcinoma. 2 patients were diagnosed with inconclusive specimens.

OTHER LESIONS

1) Anterior mediastinal mass – Benign angiomatous lesion

2) Superior mediastinal mass – Chondrosarcoma rib left side (HIV positive)

3) Posterior mediastinal mass – Chondroma right side

4) Anterior mediastinal mass – Fibrofatty tissue

5) Anterior mediastinal mass – Fibromatosis

6) Posterior mediastinal mass – Fibrofatty tissue

7) Superior mediastinal mass – Fibroalveolar pattern

8) Superior mediastinal mass – Fibrovascular tissue

9) Posterior mediastinal mass – Fibrous tissue with infiltrative cell necrosis

10) Superior mediastinal mass – Low grade mucoepidermoid carcinoma

Discussion

This study on mediastinal tumors was based on a total patient strength of 71 patients. Patients age varied from the 1st decade of life to the 8th decade. In comparison, Ho et al study was based on a total of 128 patients whose age ranged from 4 to 72 years, Nandi et al based a study on 74 patients and Velit Halit on a strength of 20 patients. The age range of the study by Velit Halit was from 2 years to 55 years, while Nandi et al study had patients' mean age of 32 years. Herlitzka et al study involved 159 patients, Morrison et al included 289 patients, Le Roux involved 105 patients, Boyd et al 96, Wychulis et al included 916 patients, Fontenelle et al 64 patients, Rubush et al 157 patients, Ovrum et al 56 patients, Davis et al 354 patients and Cohen et al 216 patients.

Of the total 71 patients, 39 were male patients and the remaining 32 were female patients in the present study. In the Ho et al study of a total of 128 patients, 70 were male patients while the remaining 58 patients were females. And in the Nandi et al study , of a total of 71 patients, 43 were male and 31 were female patients.

The total of 71 patients had mediastinal masses involving all compartments of the mediastinum. On subdivision of thte masses into the separate compartments, it was found that 25 patients had masses in the anterior mediastinum i.e. 35.21% , 6 patients had masses in superior

mediastinum i.e. 8.4%, while 15 patients had masses in the middle mediastinum (21.12%) and the remaining 25 (35.21%) patients had posterior mediastinal masses. In comparison, Velit Halit study included 7 patients with anterior mediastinal masses (35%), 1 patient each with masses in the superior and middle mediastinum respectively, and the majority of patients i.e. 11 patients (55%) with posterior mediastinal masses. In the Ho et al study, 81 patients of the total 128 patients (63.3%) had anterosuperior masses, 15 patients (11.7%) had masses in the middle mediastinum and the remaining 32 patients (25%) had posterior mediastinal masses.

In the Velit Halit study, 11 patients presented asymptomatically, while 30 patients presented asymptomatically in Nandi et al study compared with 27 patients in the present study (38.02%)

Presenting symptoms ranged from cough, pain and dyspnoea to dysphagia, hemoptysis and myasthenia. The commonest symptom in the present study was cough which was seen in 36.61%, pain in 18.30% , while in the Davis et al study 60% of patients presented with cough and 30% presented with pain and discomfort. In the Ho et al study, 28.9% presented with cough and 21.2% presented with pain.. Dyspnoea was present in 5.63% of patients in the present study compared with

28.9% in the Ho et al study. Dysphagia was a minor symptom in the present study, being present in 2.8% of patients, and 2.3 % in Ho et al study, in contrast to Davis et al study which showed 16% of patients presenting with dysphagia. 20% of patients in the Davis et al study presented with fever and chills, while 3% patients had palpitations, 6.25% had SVC syndrome manifestations in the Ho et al study. Myasthenia as a major symptom, was seen in 38.03% of patients in the present study.

On the pathological classification of the mediastinal masses, it was found that 8 patients had neurogenic tumors (11.26%), while comparing with previous studies which had neurogenic tumors in 22% in the Herlitzka et al study, 34.95% in the Morrison et al study, 28.57% in the Le Roux study, 11.46% in Boyd et al study, 23.14% in Wychulis study, 10.97% in Fontenelle study, 22.93% in Rubush et al study, 33.92% in Ovrum et al study, 16.1% in Davis et al study, 18.05% in Cohen et al, 36.49% in Nandi et al study and 22.6% in Ho et al study. In the Duwe et al study, germ cell tumors made of 15% of the patients, cysts formed 12 to 20% of which 50 to 70 % were enterogenous cysts,

7 to 15% consisted of bronchogenic cysts. Of the total, 12 to 21 % formed neurogenic tumors. In the Strollo et al study, 60% consisted of

neurogenic tumors, thymomas and benign cysts while 30% consisted of lymphomas, teratomas and granulomatous masses. Vascular lesions formed 10% of the strength in Strollo et al study. In comparison, Cystic lesions formed 11.26% of the total number of patients (8 of 71 patients). Of these branchial cysts were diagnosed in 3 patients, hydatid cyst in 2 patients, granulation cyst and lymph cyst in 1 patient each.

Of the patients managed endoscopically, 2 patients had an inconclusive right bronchial lesion (50%), 1 patient had inconclusive left bronchial lesion (25%) and the remaining 1 patient had necrotic material (25%).

Thymic tumors formed about 35.21% in the present study, while they formed 8.8% in Herlitzka et al study, 16.26% in Morrison study, 16.19% in the Le Roux study, 20.83% in Boyd et al study, 24.56% in Wychulis et al study, 28.12% in Fontenelle et al study, 32.48% in Rubush et al study, 17.85% in Ovrum et al study, 18.93% in Davis et al study, 20.83% in Cohen et al study, 28.37% in Nandi et al study and 37% in Ho et al study.

Lymphomas were present in 2.8% in the study population i.e. 2 patients, while in comparison Herlitzka et al showed 7.5% lymphomas,

Morrison et al 11.41%, 20.83% in Boyd et al, 11.68% in Wychulis et al study, 21.87% in Fontenelle et al study, 8.91% in Rubush et al study, 16.07% in Ovrum and Birkeland study, 17.51% in Davis et al study, 16.66% in Cohen et al study 5.4% in Nandi et al study and 17% in Ho et al study. Interestingly in the Le Roux et al study no cases of mediastinal lymphoma was recorded. Germ cell tumors formed 11.26% in the present study compared with 16.35% in Herlitzka et al study, 12.45% in the Morrison et al study, 20% in Le Roux study, 22.92% in Boyd et al study, 10.8% in Wychulis et al study, 4.6% in Fontenelle et al study, 8.91% in Rubush et al study, 8.9% in Ovrum study, 11,8% in Davis et al study, 9.4% by Nandi et al and 22% in Ho et al study.

The remaining of the mediastinal masses were formed of enterogenous cysts, pericardial cysts and other lesser common varieties.

On analysis of the surgical approaches, it was observed that the most common approach used was the Left Posterolateral thoracotomy which comprised 26.76% of the study population, while the next common approach was the median sternotomy approach used in 16.9%. The division of the other approaches was as follows, 4.2% underwent mini sternotomy, 8.4% had right anterolateral approach, 9.8% had Left Anterolateral approach and Right Posterolateral approach in 8.4% of

patients. Of the remaining patients, 8.4% had Right and Left anterior thoracotomy and endoscopic management in 5.6 %. In comparison, Velit Halit et al study showed 50% had Right thoracotomy approach, while Left thoracotomy and sternotomy was done in 15% each.

Summary & Conclusion

The mediastinum, an important compartment of the thoracic cavity, is the site for many cystic and tumoral lesions of various tissues. Since it contains various vital organs that could be compromised by such lesions, early diagnosis and appropriate treatment should be performed as soon as possible. However, the evaluation and treatment of mediastinal masses continue to present challenging problems to the surgeons. Recent advances in diagnostic techniques and the availability of multimodality treatment regimens subsequent to surgery have enabled better therapeutic outcomes.

Primary mediastinal tumors and cysts are common in young and middle aged patients. Most masses are discovered on routine radiographic examinations in asymptomatic patients, but many lesions produce non-specific clinical manifestations. Approximately two thirds of patients have symptoms at time of presentation. The absence of symptoms is a reasonably good indicator that the tumor may be of benign origin.

Advances in imaging technology, radioisotopic improvement in cytology techniques and the introduction of radioimmunoassay, have enhanced the ability to assess more precisely the anatomic extent and

the type of mediastinal mass. CT guided needle biopsy may be valuable in the verification of malignancy in about 80 to 90 % of cases.

A proper evaluation should be done to determine the location and extension of the lesion. Since compression of the vital organs may be a significant risk, early diagnosis and proper surgical removal are mandatory . Mediastinoscopy may be necessary to make a diagnosis and respectability in this sense. Also novel approaches in anesthesia , surgical techniques, postoperative care, chemotherapy, immunotherapy and radioitherapy have improved mortality and morbidity, increasing survival and quality of life.

On overview of this study revealed that out of the 71 cases studied, thymic tumors was diagnosed in18 cases, various cystic lesions in 8 cases, neurogenic lesions in 8 cases, tumors of germ cell origin form 8 cases, lymphomas in 4, esophageal and pleural lesions 2 in each. In this study postoperative morbidity were encountered in 5 cases. 1 case of peroperative mortality. Among the postoperative morbidity, 2 cases were reopened on the day of surgery for bleeding , 4 cases had postoperative wound dehiscence which were treated appropriately. 9 cases were referred for radiotherapy and chemotherapy for further management of the disease. Thymic tumor cases associated with

myasthenia gravis (8) were treated preoperatively with 4 cycles of plasmapheresis followed by surgery and postoperatively by 4 cycles of plasmapheresis and tablet pyridostigmine was given. Patients were followed up in the neuro-medicine department. Overall analysis revealed benign mediastinal lesions in 59 and malignant in 8, specimen inconclusive in 8 cases. Among the benign lesions 51 cases had solid tumors while 8 patients had cystic lesions.

Proforma

PROFORMA

Patient Name, Age Sex :

M.R.D. No. :

Address, Occupation :

Consultant in charge unit :

D.O.A. :

D.O.S. :

D.O.D. :

Chief Complaints :

Neurologic Symptoms :

Caridiac Symptoms :

Constitutional Symptoms : Fever : Weigh Loss :

Pain :

Past History :

Family History :

General Examination	:	Pallor : Cyanosis : Ptosis : Jaundice : Pedal edema : P.R./ B.P. :
Systemic Examination	:	CVS RS Neurologic Examination :
Investigation	:	Hb, PCV, ESR ECG CXR CT Chest MRI FOB Endoscopy
Diagnosis	:	
Surgical Procedure	:	
Approach	:	R.ALT, L.ALT, MS, L.PLT, R.PLT R.AT, L.AT, MiS
Tumor Location, Size	:	
Post operative outcome	:	
Complication	:	Morbidity, Mortality
Adjuvant Therapy	:	CT, RT, Plasmapheresis

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Master Chart